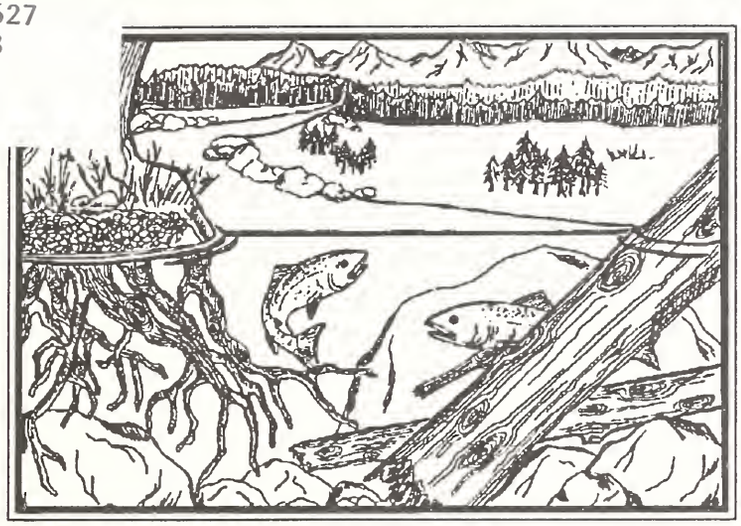

FHR CURRENTS...

R-5's FISH HABITAT RELATIONSHIP TECHNICAL BULLETIN NUMBER TWO

Six Rivers National Forest

FHR currents... Purpose

The Fish Habitat Relationships (FHR) Program of R-5 USFS has been established to research and develop information on fish ecology and to coordinate effective applications of this knowledge in managing and protecting our fisheries. By relating life stage requirements of specific species to physical habitat parameters, we are aiming at our main objective: developing a methodology to manage fisheries through the management of habitat.

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GENERAL AQUATIC RESOURCES MONITORING

Forest Service policy mandates the monitoring of resources (aquatic) to evaluate the effects of forest management activities. Monitoring programs are often plagued by problems that include: (1) unclear, unstated, or overly broad objectives, (2) a lack of concise, logical and well-thought-out quantitive design, (3) a lack of knowledge of the natural variability in the system to be monitored. These problems can lead to vast expenditures of dollars with little or no useful results. Ill-conceived monitoring programs can potentially lead to unnecessary changes in management practices. Under the proper framework, monitoring can be used as a scientific technique for evaluating the management of natural ecosystems. The following outline is intended as a tutorial on some of the aspects of monitoring to be considered.

U.S. Department of Agriculture
Forest Service
Pacific Southwest Region

It should be noted that in general, monitoring is conducted to look at some trend in a variable over time. This variable can be a true population measure or some index variable. To be able to detect this trend, it is essential that monitoring be done as a carefully framed activity with special attention given to statement of objectives, sampling design, statistical analysis and inference, and interpretation of results. It is essential to have statistical consulting throughout the whole project period.

Monitoring should be considered as separate from studies and experimentation. In general, monitoring can only detect a difference or trend in the population being monitored. Monitoring does not provide the information as to what might have caused the change. Monitoring differs from experimentation in that one has no control of the input variables, whereas in experimentation one generally has some control. Studies differ from monitoring in that one is not looking to see specific differences. Studies can be considered as data collection over time and looking at the relationships in the data to make possible inferences. Since monitoring is looking for a specific change, the analysis is set before data collection begins. In this way, the sample size is set in order to see specific differences.

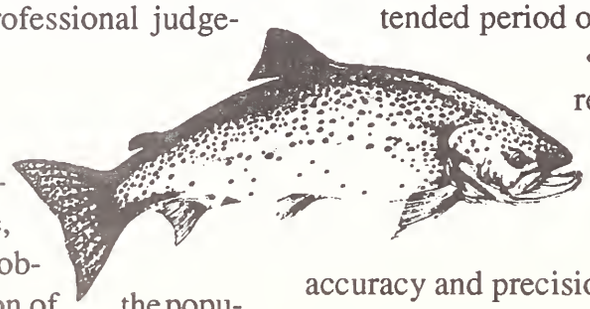
Definition: Monitoring is the collection of data over time, using a specified protocol designed to meet a specific objective.

Monitoring Objectives

The objectives of a monitoring scheme should be kept simple. An objective might be to look at whether or not a trend in some population value over time has changed or crossed some threshold. A threshold value might be, for example, a twenty-five percent decrease over some fixed number of years. The monitoring is not aimed at providing the threshold values; research or professional judgement must provide them.

The person monitoring should:

1. Keep the objective or question to be answered clear, concise, and obtainable. Implicit in the objective or question is the definition of the population of inference and some idea of the threshold values. A plan for future action should probably be included if the threshold is crossed.



2. Relate the data to be collected directly to the objectives.

3. Avoid changes in the objectives over time.

Monitoring Design Planning

The person monitoring should know or decide on what might be a significant change in population levels. This requires some knowledge of population and measurement variability. The knowledge of the variability and the size of the change considered significant are the key factors in deciding on a wanted precision of the estimates, the sample size needed to detect the change, and the accuracy of the estimates. Precision refers to the degree of conformity of the estimates from repeated applications of the measurement process. Accuracy refers to the conformity of the estimate to the truth. The sample size needed to detect a change is a function of the accuracy, precision and variability in the estimate. Preliminary sampling or prior studies provide on the variability.

The person monitoring should:

1. Decide on the sample accuracy; how far can the estimate be from the **true** parameter.

2. Have an idea of the variability in what is measured and decide on the precision of the estimates. The following are sources of variability and ways to quantify them:

- observer bias—standardize field procedures
- natural variation in population—increase sample size or stratify
- between-year variability—monitor for an extended period of time
- sampling variability—resample selected units over time

3. Decide about the sample size according to the accuracy and precision established in 1 and 2, keeping in mind that increases in precision and accuracy will increase sample size, and therefore cost.

Sample Planning

The sampling plan should be considered with the thought that it will take place over an extended period of time, and that it will be administered by different individuals. This implies that sampling should be standardized to duplicate what has been done in the beginning. With this in mind, any assumptions should be clearly stated. Simplicity in the design and a well planned random sampling scheme ensures that others will be able to implement it.

The person monitoring should:

1. Keep experimental designs simple and clearly state the assumption being used.

2. Keep the measurements consistent: standardize field procedures.

3. Design the sampling to be quick and as easy as possible.

4. Select experimental units at random.

5. Plan the electronic data storage.

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